

a dermal bone of the cranial roof of a Dipnoan, an interesting bone of *Ctenodus* being figured for comparison. The Old Red Sandstone fossil, named *Phyllolepis concentricus* by Agassiz, is also interpreted as probably the head-bone of a closely-allied fish; and the remarkable skull-fragment known as *Archæonectes pertusus*, H. von Meyer, is considered to be the bony portion of the palate, wanting the teeth.

To the appended synopsis of the literature of the subject, we might add two important papers on *Ctenodus*, by W. J. Barkas, published in the Proceedings of the Royal Society of New South Wales, 1876-77; and the list of known Palæozoic Dipnoan fishes must be reduced by one (*Strigilina*), which is founded upon a tooth of a Selachian. We would also remark that the so-called *Campylopleuron* is almost certainly founded upon the tail of *Ctenodus*, as pointed out by Dr. Traquair (NATURE, vol. xviii. p. 483). In every respect, however, the memoir affords evidence of the most elaborate and painstaking research; and it must long remain a standard work of reference for all who are interested in the palæontology of the Dipnoan fishes.

A. S. W.

OUR BOOK SHELF.

A Revision of the Heterocyst Nostocaceæ. By Ed. Bornet and Ch. Flahault. (Separate reprint with index.) (Paris, 1886-88.)

In this very important contribution to our knowledge of this interesting group of Algæ, the publication of which commenced in the third volume of the *Annales des Sciences Naturelles*, vii. série (1886), and was concluded in the seventh volume, published this year (1888), we have a work of great labour and research, upon the happy completion of which the authors are to be congratulated.

Those who have investigated the forms of these Algæ will remember the extreme difficulties they have experienced in determining the so-called species of many of the authors whose works they were obliged to consult. Too often it has happened that, unable to recognize a form collected, it has been described as new, and so but added to the big pile of synonyms.

Accepting the division of the hormogonous Nostocs into the two subdivisions of those with "uniform cells" and those with "dissimilar cells," it is with the latter group that the present "Revision" has to do. For many years the authors have investigated all the examples, living or dried, that they could procure. The herbaria of Brébisson, Chauvin, Grunow, Lenormand, Thuret, and the collections of the Museum of Paris, have all been consulted, with the result that an immense mass of described species have been treated as synonyms; while a certain number, of which type-specimens were not to be had, or on account of difficulties of referring them to known genera, have been enumerated as "species inquirendæ."

Introductory to the description of the genera and species we have an account, up to the present state of our knowledge, of the vegetative cells, the filaments, and the trichomes, the outer envelope (cytiderm), the heterocysts, the ramification, the hormogonia, and the spores. Of these two latter modes of reproduction, that by the "hormogones" has been the longest known, and is the one to be found in most of the genera; while that by "spores," destined to preserve the species during the intervals of vegetation, and enabling it to resist desiccation, is known only to occur in some few of the genera, but the authors add "that it is permissible to think that it will soon be known to occur in all." These spores are easily distinguished by their size, their more rounded

form, and their more marked granular contents. They often possess a brownish-yellow episore; in some instances they have been proved to retain their vitality for a considerable time; the spores of *Cylindrospermum licheniforme*, Kutzing, have germinated after a nine years' sojourn in a dried state, in an herbarium. About their behaviour just at the period of germination we have still something to learn. The "conidia" of Borzi are also alluded to. A conspectus of the genera of each of the four tribes of the sub-family is given; the four tribes recognized being the Rivulariaceæ, Sirosiphoniaceæ, Scytone-maceæ, and Nostocaceæ. After the list of genera comes the list of species, with analytical keys and detailed diagnosis of each. There is a very full account of the geographical distribution of all the species.

In a notice the main object of which is to call the attention of our readers interested in these for the most part fresh-water Algæ, it would not be proper to enter into minute details, so we will content ourselves with a statement of our belief that this memoir of Dr. E. Bornet and M. Flahault will not only do very much to assist the botanist, but will also go far to awaken a new interest in a group of plants in which there is abundant field for further research.

E. P. W.

LETTERS TO THE EDITOR.

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Mr. Spottiswoode's Mathematical Papers.

AT the request of Mrs. Spottiswoode, I have undertaken to edit these papers. Mrs. Spottiswoode has kindly looked over her collection, and put into my hands author's copies of such papers as she has. I still lack the following, which some one or more of the late President's friends may perhaps be able to lend me. The numbers are those of the Royal Society's Catalogue.

I. *Phil. Mag.*, xxxvi. (1850); VI. *Crelle*, xlii. pp. 169-78; VIII. Tortolini, *Annali*, iii. (1852); IX., X. *Camb. and Dub. M. Journ.*, viii. (1853); XIII. R.S. Proc., vii. (1854); XX., XXI. same, xi. (1860); XXII. [as regards Geog. Soc. Proc., v. (1861)]; XXIV. Brit. Assoc. Report (1861); XXV. *Crelle*, lix. (1861); XXXIII. [as regards *Quart. Journ.*, vi. 1864]; XXXVII., XXXVIII., *Quart. Journ.*, vii. (1866); XLVIII., XLIX., and some other papers in the *Comptes rendus* (1874-76). I am especially anxious to receive the first part of the "Meditations Analyticæ," of which we have not found a complete set. All the papers are in Mrs. Spottiswoode's library, she believes; but I am anxious to preserve these if possible from passing into the printers' hands.

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Statistics of the British Association.

IT is to be feared that the "ladies' curve" in the diagram (NATURE, December 13, p. 153) fails to give anything like accurate information respecting the number of ladies at the meetings of the British Association. Omitting foreigners, the attendance is made up of "members," "associates," and "ladies," but, as a matter of fact, a large number of ladies are members or associates, while only the remainder take "ladies' tickets,"—that is, tickets transferable to ladies, the only transferable tickets issued by the Association.

The column headed "Ladies," in the table (see the Association's Report for 1887, pp. lv.-lvi.) states that 493 ladies attended the last Manchester meeting; but that merely shows that 493 of the ladies who were present took "ladies' tickets," and does not include the lady members and lady associates who were at that meeting. During its meetings the Association publishes lists of the members and associates who are present, exclusive of the holders of "ladies' tickets." By going over the Manchester lists it will be found that upwards of 700 ladies who were either members or associates were in attendance; so that,

including the three groups, more than 1200 ladies attended the Manchester meeting, instead of 493 only. Again, of the ladies at the recent Bath meeting, there were 84 members, *plus* 455 associates, *plus* the, to me, unknown number who took "ladies' tickets."

WM. PENGELLY.

Torquay, December 18.

On the Formulæ of the Chlorides of Aluminium and the Allied Metals.

IN recent numbers of NATURE there have appeared several interesting accounts of determinations of the vapour-densities of certain metallic chlorides. According to the views generally held by chemists, the molecules of some of these chlorides should

be represented by the general formula M_2Cl_6 , but conclusions are drawn from the experiments described (1) that the formula MCl_3 is applicable to all these chlorides; (2) that the chlorides of the formula M_2Cl_6 are probably incapable of existence in the gaseous state, and that this formula should therefore be given up; (3) that the lower chlorides of these metals should be expressed by the general formula MCl_2 instead of M_2Cl_3 , chlorides corresponding to the second formula being incapable of existence.

In view of the great interest that is felt in this question at the present time, it seemed to me that a tabulated statement of the results obtained by various chemists would be of value, in order that a comprehensive view of the question might be obtained:—

VAPOUR-DENSITIES (AIR = 1) OF CHLORIDES, &c.

Aluminium chloride: M.P. 187° ; B.P. 183° . Calc. $\begin{cases} Al_2Cl_6 = 9.2. \\ AlCl_3 = 4.6. \end{cases}$

Temperature.	Pressure.	Vapour-Density.	Method.	Observer.	Remarks.
$^\circ C.$					
350	1 atm.	$\begin{cases} 9.38 \\ 9.32 \end{cases} 9.35$	Dumas	Deville and Troost	
440	"	$\begin{cases} 9.34 \\ 9.33 \\ 9.37 \end{cases} 9.35$	"	"	
218	0.59 atm.	No result	V. Meyer	V. Meyer	Dissociated at 697° .
218.3	0.88	8.87	Dumas	Friedel and Crafts	In a later paper these observers state that they heated aluminium chloride to a very high temperature, and allowed the vapour to diffuse through a porous substance, but were unable to detect the presence of free chlorine.
218.3	0.99	9.17			
218.1	0.39	9.69			
218.1	0.29	9.54			
218.1	0.29	9.34			
218.1	0.40	9.93			
263.2	0.98	9.50			
263.7	0.99	9.51			
306.5	0.97	9.46			
306.5	0.95	9.44			
356.9	0.89	9.34			
356.9	0.97	9.17			
357.3	0.96	9.42			
398.2	0.97	9.20			
390	0.79	9.11			
400	0.95	9.27			
415	0.57	8.73			
429	0.97	8.31			
429	0.54	8.71			
429	0.87	8.39			
433	0.90	8.96			
440		7.79	V. Meyer	Nilson and Pettersson	
758		4.80			
835		4.54			
943		4.56			
1117		4.27			
1244		4.25			
1260		4.28			

Aluminium bromide $\begin{cases} AlBr_3 = 9.2. \\ Al_2Br_6 = 18.4. \end{cases}$

440	1 atm.	18.62	Dumas	Deville and Troost
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Aluminium iodide $\begin{cases} AlI_3 = 14.0. \\ Al_2I_6 = 28.1. \end{cases}$

440	1 atm.	27.00	Dumas	Deville and Troost
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Aluminium ethyl: B.P. 194° . $\begin{cases} Al(C_2H_5)_3 = 3.93. \\ Al_2(C_2H_5)_6 = 7.86. \end{cases}$

234	?	4.5	Gay Lussac	Buckton and Odling
235		$8.0 + 8.2 = 8.1$	V. Meyer	Louise and Roux
258		$6.0, 6.3, 6.4 = 6.2$		
310		2.5		
350		2.5		

} Complete decomposition

Louise and Roux obtained results agreeing with the formula $Al_2(C_2H_5)_6$ by Raoult's freezing-point method, employing ethylene dibromide as solvent.